REMARKS

The final Office Action was issued on pending claims 1-9. Claims 1-9 stand rejected. In this Response, claims 1, 3-5 and 8 have been amended, and no claims have been added or cancelled. Thus, claims 1-9 are pending in the application.

Applicants invite the Examiner to call Applicants' representative to discuss any issues regarding this patent application so that the application can be quickly placed in condition for allowance.

Claim Rejections – 35 U.S.C. § 103

In Office Action paragraph 1, claims 1-4, and 6-8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kobayashi et al. "Fluorinated Polyimide Waveguides with Low Polarization-Dependent Loss and their Applications to Thermooptic Switches" in view of Yamashita et al. (JP 59-33430) and Kenney et al. (US 6,311,004). In Office Action paragraph 2, claim 5 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kobayashi et al. in view of Yamashita et al., and further in view of Cohen et al. (US 5,418,868). In Office Action paragraph 3, claim 9 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kobayashi et al. in view of Yamashita et al., and further in view of Ooba et al., "Low crosstalk and low loss 1x8 digital optical switch using silicone resin waveguides". Applicants respectfully disagree.

Claims 1-9

Initially, claims 1, 3-5 and 8 have been amended to clarify the claims. Claim 1 has been amended to clarify that the optical switch has first and second branching section heaters at opposite sides of the branching section for heating different portions of the branching section. The optical switch also has at least first and second branched core heaters for heating the plural branched cores. Claim 1 has also been amended to clarify the control of the branching section heaters separately from the control of the branched core heaters. Claim 1 recites the first branching section heater and the first branched core heater being controlled separately and permitting individual heating conditions of the branching section and a selected branch core. Claim 1 also recites the second branching section heater and the second branched core heater

controlled separately and permitting individual heating conditions of the branching section and another selected branched core.

Referring to the example of Applicants' invention shown in Fig. 1, an optical switch has first and second branching section heaters 11, 13 at opposite sides of the branching section 4b. The first and second branching section heaters 11, 13 heat different portions of the branching section 4b. First and second branched core heaters 12, 14 heat branched cores 5a, 5b. The branching section heater 11 and the branched core heater 12 are controlled separately and permit individual heating conditions of the branching section 4b and branched core 5a. The branching section heater 13 and the branched core heater 14 are controlled separately and permit individual heating conditions of the branching section 4b and the branched core 5b. See also, the specification at page 8, line 21 through page 9, line 9.

Claims 3-5 and 8 have been amended merely to be consistent with amended claim 1.

Applicants respectfully submit that the references relied on in the Office Action do not disclose or suggest Applicants' invention, as claimed in claim 1. Kobayashi et al. shows in Fig. 9a a single heater 1 and a single heater 2. Heater 1 of Kobayashi et al. heats both the branching area P_O and port 1. Similarly, heater 2 heats both the branching area P_O and the port 2. Nowhere does Kobayashi et al. disclose or suggest that heater 1 is a branching section heater and a branched core heater which are controlled separately to permit individual heating conditions of the branching area P_O and the port 1. The same comment applies to heater 2.

Turning to Yamashita et al., Yamashita et al. shows in Fig. 1 a single heater 6 for the branching area 3. Heater 7 is provided on branch part 4 and heater 8 is provided on branch part 5. Nowhere does Yamashita et al. disclose or suggest that heater 6 is first and second branching section heaters at opposite sides of the base part 3. Furthermore, Yamashita et al. does not disclose or suggest that heater 6 is two heaters in which each of those heaters is controlled separately from a corresponding branch part heater 7 or 8 such that the base part 3 and each branch part 4 and 5 have individual heating conditions.

As to Kenney et al., Kenney et al. shows in Fig. 5 an active region 504 having heaters 506. Each heater 506 appears to heat both the branching area and its respective branched core. Kenney et al. does not disclose or suggest that each heater 506 is a branching section heater and a branched core heater controlled separately to permit individual heating conditions of the branching area and the selected branched core.

As to Cohen et al., Cohen et al. shows in Fig. 1 a heater 120 which heats core a segment 110. Cohen et al. does not disclose or suggest that heater 120 is a branching section heater and a branched core heater controlled separately to permit individual heating conditions of a branching section in a selected branched core.

As to Ooba et al., Ooba et al. does not remedy the deficiencies of the other references.

Thus, Applicants respectfully submit that the § 103 rejections have been overcome.

Further Reasons for Non-Obviousness

Applicants further submit that the combination of references asserted in the Office Action, if such combination is proper, do not render Applicants' claimed invention obvious.

Yamashita et al.

The Office Action asserts "Yamashita et al. teaches a branching section heater and branched core heaters controlled separately as a set. (Fig. 1 , #6, 7, and 8, and Fig. 3)."

However, Yamashita et al. divides light by a combined use of a heater 6 and a heater 7, or a combined use of heater 6 and a heater 8. Referring to Yamashita et al. Fig. 1, heaters 6 and 7 must be located close together and heaters 6 and 8 must also be located close together to change the light path. Yamashita et al. changes the light path by increasing the refractive index due to heating. The heated branch draws the light away from the non-heated branch. Thus, in Yamashita et al. it is not possible to change the direction of the light if the heaters 6 and 7 are not sufficiently close together and the heaters 6 and 8 are not sufficiently close together. See the second paragraph of the English language translation of Yamashita et al. submitted on October 3, 2002.

In contrast, branched core heaters (for example, heaters 12 and 14) of the present invention are disposed away from the branching section 4b by distances (such as more than 40 μm in claim 5), for the purpose of attenuating light so as to prevent the insertion loss. Turning to claim 1, claim 1 calls for "each branched core heater having distances from the branched core and a portion of the branching section facing the branched core so as not to disturb a light-branching operation" which is not disclosed or suggested by Yamashita et al.

Heaters 7 and 8 of Yamashita et al. must be located as close as possible to heater 6 and the portion of the base section 3 covered by heater 6. In contrast, the branched core heaters (for

example, heaters 12 and 14) of Applicants' invention are located away from the branching section heaters (for example, heaters 11, 13) relative to the heaters 3 and 6 in Fig. 1 of Yamashita et al. Such a spacing is advantageously at least 40 μm in the present invention. The heaters 7 and 8 in Fig. 1 of Yamashita et al. have different features compared to the branched core heaters (12 and 14) claimed in the present invention because of their purpose and location.

Furthermore, the heater 6 and heater 7 in Fig. 1 in Yamashita et al. must be operated simultaneously to change the light path. Also, the heater 6 and heater 8 in Fig. 1 in Yamashita et al. must be operated simultaneously to change the light path. In contrast, the branched core heaters (12 and 14) of Applicants' invention are completely independent of heaters which divide a light because the branched core heaters 12 and 14 attenuate light.

Again, Applicants' heaters are located away from each other, whereas the heaters in Yamashita et al. must be located close to each other.

Applicants' invention provides advantages over Yamashita et al. Yamashita et al. may provide an effect only that a light can be divided with high extinction ratio. In contrast, the branched core heaters 12 and 14 of the present invention realize a high extinction ratio and low insertion loss compatibly, which is an improvement over the effect obtained in Yamashita et al.

Kenney et al.

The Office Action asserts that "Kenney et al. teaches each branch heater a distance from the branched core and branching section so as not to disturb a light-branching operation (Fig. 5, #506)."

However, Kenney et al. does not disclose or suggest this claimed feature. Nowhere does Kenney et al. describe the heater 506 as being a distance from the branched core and branching section so as not to disturb a light-branching operation. Rather, the heater 506 arrangement in Fig. 5 of Kenney et al. appears to be basically the same as the heater arrangement in Fig. 1 of Kenney et al. Also, the heater 506 arrangement in Fig. 5 of Kenney et al. appears to be basically the same as that of the Y-branching optical switch of Kobayashi et al. Therefore, Applicants respectfully submit that Kenney et al. does not disclose or suggest each branch heater being a distance from the branched core and branching section as claimed in claim 1.

Kenney et al. does not disclose or suggest at all that the heaters must be located away from the core. In Kenney et al., the heater is located on a "coat" such as an upper cladding.

Thus, the Kenney et al. heater is separated by the thickness of the upper cladding, and not located at a distance as claimed in claim 1. Also, in Kenney et al., two heaters are located horizontally separate so as to realize a light-branching-function; however, such a description does not indicate at all that the heaters are located as claimed in claim 1.

Furthermore, in Fig. 5 of Kenney et al., a part of a silica glass PLC is replaced by a polymer PLC so as to make an active region with the heater 506. In Kenney et al., the active region 504 in Fig. 5 is the same as the corresponding region in Fig. 1 of Kenney et al. Such a region 504 is also the same as the Y-branching optical switch of Kobayashi et al. Again, Kenney et al. does not show or describe that the heater 506 or active region 504 in Fig. 5 as having the structure as claimed in claim 1.

Cohen et al.

The Office Action rejected claim 5 by the assertion that "Cohen et al. teaches a minimum distance of 40 μm or more from a branching core heater (Fig. 1, #120) and a center of the core adjacent (Fig. 1, #115) and a branching section (Fig. 1, #20)."

However, a close review of Cohen et al. shows that there is no description of 40 μm as a minimum distance for the heater in Fig. 1 of Cohen et al. Rather, Cohen et al. merely describes that "The cores of segments 110 and 115 were embedded in a silica cladding layer 260 that was uniformly 30 μm thick and were separated by 200 μm." (See Cohen et al., column 5, lines 62-65).

The "200 μm" distance in Cohen et al. apparently is a distance between the cores. Such a feature is completely different from Applicants' claimed feature of "a minimum distance separating a branching core heater for heating one branched core of the plural branched cores and a center of a core adjacent to said one branched core is 40 μm or more" in claim 5 of the present invention. Also, Cohen does not even mention a reason why the 200 μm distance is preferable, and certainly does not describe the 200 μm distance being the structure claimed in claim 5. Furthermore, the claimed "40 μm or more" distance in claim 5 was discovered by the inventors of the present invention according to experiments. (See page 9, lines 10 to 19, of the present specification).

Cohen et al. does not clearly describe the distance between segment 115 and heater 120 or an advantage to a particular distance. In Cohen et al., under conditions that the width of the

heaters are 30 μm (Cohen et al., column 5, line 65) and the distance between the cores is 200 μm, the distance between the core center and heater may be 185 μm if it can be assumed the center of the heater and the center of the core are aligned.

In contrast, in the present invention, the 40 μm as "a minimum distance separating a branching core heater for heating one branched core of the plural branched cores and a center of a core adjacent to said one branched core" in claim 5 is distinctively shorter than 185 μm. Such a shorter distance can be realized in the present invention by a polymer waveguide member, for example.

In Cohen et al., the distance between the 115 and 120 is determined according to a necessary distance between branch 90 and branch 100. In conventional common understanding in the art, 100's or 1000's of μm has been necessary for such a distance. Such a distance is far larger than a minimum distance of 40 μm or more for separating a branching core heater for heating one branched core of the plural branched cores and a center of a core adjacent to said one branched core in the present invention. Thus, Applicants submit that this feature of the present invention is not disclosed or suggested in Cohen et al.

As to the remaining dependent claims, the claims are allowable at least for the reasons discussed above regarding claim 1.

Therefor, the combination of the references asserted in the Office Action does not render Applicant's claimed invention obvious.

The above remarks distinguish Applicants' claimed invention from the combination of references asserted in the Office Action. However, Applicants further submit that the references are not properly combinable under §103 as asserted in the Office Action. Because of the significant differences between the cited references as discussed above, there is no teaching, motivation, or suggestion to combine the references as asserted in the Office Action. The previous Response to Office Action submitted October 3, 2002 further discusses the absence of a teaching, motivation, or suggestion to combine the references.

Thus, Applicants respectfully submit that the §103 rejections have been overcome.

CONCLUSION

For the foregoing reasons, Applicants submit that the patent application is in condition for allowance and request a Notice of Allowance be issued.

Respectfully submitted,

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